INDOOR AIR QUALITY ASSESSMENT

Lunenburg High School
1079 Massachusetts Avenue
Lunenburg, Massachusetts

Prepared by:
Massachusetts Department of Public Health
Bureau of Environmental Health Assessment
February 2008

Background/Introduction

At the request of John Londa, Director of Facilities and Grounds for the Lunenburg School Department, the Massachusetts Department of Public Health (MDPH), Bureau of Environmental Health (BEH) provided assistance and consultation regarding indoor air quality at the Lunenburg High School, 1079 Massachusetts Avenue, Lunenburg, Massachusetts.

On November 20, 2007, a visit to conduct an indoor air quality assessment was made to this school by Michael Feeney, Director of BEH's Indoor Air Quality (IAQ) Program, and Susan Koszalka, the Northeast Regional Inspector within BEH's IAQ Program. Mr. Feeney and Ms. Koszalka were accompanied by Mr. Londa during the assessment. The building was previously visited by BEH staff in November 2001. A report was issued detailing conditions observed at the time of the visit (MDPH, 2001). Appendix A is a summary of actions taken in response to the previous assessment.

Methods

Air tests for carbon monoxide, carbon dioxide, temperature and relative humidity were taken with the TSI, Q-Trak, IAQ Monitor, Model 8551. BEH staff also performed a visual inspection of the building materials for water damage and microbial growth.

Results

The school houses approximately 550 students in grades 9 through 12 and approximately 70 staff members. The tests were taken during normal operations at the school. Test results appear in Table 1.

Discussion

Ventilation

It can be seen from the Table 1 that carbon dioxide levels were elevated above 800 parts per million of air (ppm) in 38 of 48 areas surveyed, indicating inadequate fresh air ventilation in most areas tested. Fresh air in classrooms is supplied by a unit ventilator (univent) system (Figure 1). Univents draw air from outdoors through a fresh air intake located on the exterior walls of the building and return air through an air intake located at the base of each unit. The mixture of fresh and return air is drawn through a filter and heating coil, and is then expelled from the univent by motorized fans through fresh air diffusers. Obstructions to airflow, such as papers and books stored on univents and bookcases, carts, desks and other materials in front of univent returns were seen in a number of classrooms. Some univents also contained accumulated dirt/debris. These univents should be cleaned before operating to prevent aerosolization of this material. In order for univents to provide fresh air as designed, intakes must remain free of obstructions. Importantly, the units must remain "on" and allowed to operate while these rooms are occupied.

Univent fresh air intakes in several locations (i.e. the enclosed courtyard, outer exterior wall of the building) are located within subterranean, cement-walled pits (Picture 1). An accumulation of leaves and debris was observed below a number of these fresh air intakes. Wet leaves can provide a source for mold growth and odors that can be entrained into the building by the air handling equipment.

Exhaust ventilation in classrooms is provided by a mechanical system consisting of ducted, grated wall vents. Exhaust ventilation was not operating efficiently in some

areas during the assessment. Several exhaust vents were blocked by desks or other items. In order for exhaust ventilation to function as designed, vents must be activated and remain free of obstructions.

To maximize air exchange, the MDPH recommends that both supply and exhaust ventilation operate continuously during periods of school occupancy. In order to have proper ventilation with a univent and exhaust system, the systems must be balanced to provide an adequate amount of fresh air to the interior of a room while removing stale air from the room. According to school department officials, the date of the last balancing of these systems was not available at the time of the assessment. It is recommended that existing ventilation systems be re-balanced every five years to ensure adequate air systems function (SMACNA, 1994).

The Massachusetts Building Code requires a minimum ventilation rate of 15 cubic feet per minute (cfm) per occupant of fresh outside air or have openable windows in each room (SBBRS, 1997; BOCA, 1993). The ventilation must be on at all times that the room is occupied. Providing adequate fresh air ventilation with open windows and maintaining the temperature in the comfort range during the cold weather season is impractical. Mechanical ventilation is usually required to provide adequate fresh air ventilation.

Carbon dioxide is not a problem in and of itself. It is used as an indicator of the adequacy of the fresh air ventilation. As carbon dioxide levels rise, it indicates that the ventilating system is malfunctioning or the design occupancy of the room is being exceeded. When this happens a buildup of common indoor air pollutants can occur, leading to discomfort or health complaints. The Occupational Safety and Health

Administration (OSHA) standard for carbon dioxide is 5,000 parts per million parts of air (ppm). Workers may be exposed to this level for 40 hours/week, based on a time weighted average (OSHA, 1997).

The MDPH uses a guideline of 800 ppm for publicly occupied buildings. A guideline of 600 ppm or less is preferred in schools due to the fact that the majority of occupants are young and considered to be a more sensitive population in the evaluation of environmental health status. Inadequate ventilation and/or elevated temperatures are major causes of complaints such as respiratory, eye, nose and throat irritation, lethargy and headaches. For more information concerning carbon dioxide, please see Appendix B.

Temperature readings ranged from 66° F to 73° F, which were within or close to the lower end of the MDPH recommended comfort level. The MDPH recommends that indoor air temperatures be maintained in a range between 70° F to 78° F in order to provide for the comfort of building occupants. It is difficult to control temperature and maintain comfort without the ventilation equipment operating as designed. In many cases concerning indoor air quality, fluctuations of temperature in occupied spaces are typically experienced, even in a building with an adequate fresh air supply. Lack of ventilation can lead to poor indoor air quality and comfort complaints. While temperature readings outside the recommended range are generally not a health concern, decreased temperature can affect the relative humidity in a building.

The relative humidity measurements ranged from 23 percent to 39 percent, below the MDPH recommended comfort range. The MDPH recommends a comfort range of 40 to 60 percent for indoor air relative humidity. Relative humidity levels in the building would be expected to drop during the winter months due to heating. The sensation of

dryness and irritation is common in a low relative humidity environment. Low relative humidity is a very common problem during the heating season in the northeast part of the United States.

Microbial/Moisture Concerns

Plants were noted throughout the school. A number of classrooms have water damaged windowsills that appear to have resulted from over watering of plants . In several rooms, large plants are located on wall-to-wall carpeting (Picture 2). Plants should be properly maintained and equipped with drip pans. Plants should be located away from ventilation sources (e.g., air intakes, univent diffusers) to prevent the entrainment and/or aerosolization of dirt, pollen or mold.

Water-damaged ceiling tiles were observed in several areas (Table 1), which can indicate leaks from the roof or plumbing system. Water-damaged ceiling tiles can provide a source for mold growth and should be replaced after a water leak is discovered and repaired. Water-damaged ceiling materials, some of which appeared to be constructed of gypsum wallboard, were observed in several classrooms and offices.

The US Environmental Protection Agency (US EPA) and the American Conference of Governmental Industrial Hygienists (ACGIH) recommend that porous materials be dried with fans and heating within 24 to 48 hours of becoming wet (US EPA, 2001; ACGIH, 1989). If not dried within this time frame, mold growth may occur. Once mold has colonized porous materials, they are difficult to clean and should be removed/discarded.

Within the central courtyard is a greenhouse. Also within this area is a compost heap in close proximity to a classroom fresh air intake. Compost heaps may be a source of odors as materials degrade, particularly if the piled materials are not turned regularly. As with shrubbery, compost heaps can be a source of odor, particulates and microbes that can be entrained by the univents in the courtyard.

Other Concerns

A number of other conditions that can affect indoor air quality were noted during the assessment. An odor was detected in Room 222. This odor was traced to a storage closet, containing ductwork from the water heater (Picture 3), which is located in the crawlspace below room 222. The seams to the exhaust ductwork were not sealed with mastic. When the exhaust system for the water heater is activated, combustion products are driven up the ductwork. As a result, the vent becomes pressurized. Therefore, if any unsealed holes or seams exist in the ductwork, the combustion products from the gas-fired water heater can escape from the ductwork. No measurable levels of carbon monoxide were detected in Room 222 or its closet during this assessment.

BEH staff examined the hot water heater (Picture 4) and detected a noticeable metallic taste when in close proximity to the water heater, while the exhaust system *was deactivated*. Metallic tastes are an unusual occurrence; this may indicate a malfunction in the water heater that is producing metal fume during its operation. Metal fumes may also enter Room 222 via holes or seams in the ductwork or migration the spaces between the ducts and the floor in the closet. Products of combustion and metal fumes can be sources of eye, nose and throat irritation.

A strong sewage odor was observed in the area where the sewage ejector pumps are located. As reported by Mr. Londa, a backhoe breached a PVC pipe that encloses the telephone lines located outside the building. The breach resulted in water penetration to the sewage ejector room (Picture 5). In order for water to drain from this room, a jerry-rigged drain system was installed in the sewage collect tank, thereby allowing odors to escape from the sewage ejector system. In this condition, groundwater and odors from the broken pipe and the sewage ejector system could all be sources of odor in this room. An exhaust fan was installed in this room, but it was deactivated at the time of the assessment.

The chemistry classroom contains a chemical fume hood. The efficacy of the draw of air through this equipment could not be determined. In addition, no record of the last date of calibration of the chemical hood was readily apparent. Chemical hoods should be calibrated on an annual basis to ensure proper function. No dated inspection sticker indicating such could be found on the hood.

A number of food containers being reused in several classrooms were noted. No labeling on the containers was observed. Exposed food products and reused food containers can attract a variety of pests. The presence of pests inside a building can produce conditions that can degrade indoor air quality. For example, rodent infestation can result in indoor air quality related symptoms due to materials in their wastes. Mouse urine is known to contain a protein that is a known sensitizer (US EPA, 1992). A sensitizer is a material that can produce symptoms in exposed individuals, including nose irritations and skin rashes. Pest attractants should be reduced/eliminated. Proper food storage is an integral component in maintaining indoor air quality. Food should be

properly stored and clearly labeled. Reuse of food containers (e.g., for art projects) is not recommended since food residue adhering to the container surface may serve to attract pests.

Several abandoned sinks and one abandoned eyewash station were observed. The traps for these drains can dry out which can lead to sewer gas odors penetrating the room through unsealed traps. Sewer gas odors can be irritating to the eyes, nose, and throat.

A chemistry storage area on the lower level contained a standard-sized refrigerator with small containers in the freezer; the freezer's ice buildup was evident. In order for a refrigerator system to work properly, the freezer should be defrosted and cleaned according to manufacturer's instructions. A smaller refrigerator was also present in the area. An electrical smell was detected.

The gymnasium had cracked block windows, as originally noted in the BEH assessment of 2001 (Picture 6). Glass window blocks were heavily damaged by vandalism in many classrooms. Exterior surfaces of glass blocks are either broken or cracked. Several glass blocks were broken in a manner to allow for water to accumulate within the block, creating an "aquarium-like" appearance.. Damage to blocks can lead to water penetration through masonry and serve as a potential microbial growth source. Moistened cardboard can be a mold growth medium. Standing water in these blocks can stagnate leading to bacterial growth, mold growth and possible nuisance odors.

Most classrooms contained dry erase boards and dry erase markers. Materials such as dry erase markers and dry erase board cleaners may contain VOCs, (e.g., methyl isobutyl ketone, n-butyl acetate and butyl-cellusolve) (Sanford, 1999). Several cans of air freshener were observed in various areas of the school, including some classrooms.

Air fresheners and dry erase markers can be irritants to the eyes, nose and respiratory system.

A number of areas are cooled using wall or window-mounted air conditioners (WMAC). Some air conditioners have the capacity to introduce fresh air, however the majority of installed machines recycle indoor air only.

Conclusions/Recommendations

The conditions noted at the Lunenburg High School raise several indoor air quality concerns. A two-phase approach is required to adequately address overall indoor air quality concerns. This approach consists of **short-term** measures to improve air quality and **long-term** measures that will require planning and resources. In view of the findings at the time of the visits, the following recommendations are made:

Short Term Recommendations

1. The jerry-rigged drain system for the broken PVC telephone wire should be rendered air tight and all seams in the sewage ejector system should be sealed. The exhaust fan in the room should be operating during school operating hours at minimum.
2. Seal all the seams and holes in all ductwork in the room 222 closet with an appropriate sealing compound. Spaces between the floor and duct should also be sealed. Consider consulting a ventilation engineer to identify the metal fume source in the water heater. Consideration should be give to relocating the exhaust vent motor to the roof so that the water heater exhaust vent is internally depressurized.

3. Remove leaves and other debris from univent fresh air intake subterranean pits, clean and inspect periodically.
4. Ensure classroom doors are closed to maximize air exchange.
5. Operate both supply and exhaust ventilation continuously during periods of school occupancy independent of classroom thermostat control to maximize air exchange.
6. Examine each univent for function. Survey classrooms for univent function to ascertain if an adequate air supply exists for each room. Operate fresh air supply univents while classrooms are occupied. Consider consulting a heating, ventilation and air conditioning (HVAC) engineer concerning the calibration of univent fresh air control dampers school-wide.
7. Remove all blockages from univents and exhaust vents.
8. Consult a ventilation engineer concerning re-balancing of the ventilation systems. Ventilation industrial standards recommend that mechanical ventilation systems be balanced every five years (SMACNA, 1994).
9. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, implementation of scrupulous cleaning practices should be implemented. This will minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. Use of vacuum cleaning equipment outfitted with a high efficiency particulate arrestance (HEPA) filter is recommended. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).

10. Move plants away from univents in classrooms. Ensure plants have drip pans, and examine drip pans for mold growth and disinfect areas of water leaks with an appropriate antimicrobial where necessary.
11. Relocate compost pile from inner courtyard.
12. Remove plants from floor with wall-to-wall carpeting. Consider reducing the number of plants.
13. Cut shrubbery in a manner to maintain a space of 3 feet from univent fresh air intakes.
14. Defrost refrigerator and remove chemical containers. If containers are damaged, dispose of chemicals in a manner consistent with Massachusetts hazardous waste laws and regulations.
15. Refrain from using strongly scented materials (e.g., air fresheners).
16. Ensure chemical fume hoods in the science areas are operating properly. Science staff should work with school administration and their HVAC vendor to develop a preventative maintenance program for all local exhaust equipment (e.g. lab hoods, prep rooms).
17. Refrain from re-using food containers.

Long Term Recommendations

1. Examine the feasibility of replacing damaged gymnasium block windows.
2. Repair the broken PVC telephone conduit.

References

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Picture 1

Cement Lined Pit Containing Univent Fresh Air Intake

Picture 2

Plant On Carpet

Picture 3

Ductwork In Closet, Room 222

Picture 4

Water Heater

Picture 5

Telephone Conduit Leaking Water In Sewage Ejector Room

Picture 6

Damaged Glass Block, Gymnasium

Location: Lunenburg High School **Indoor Air Results**

Address: 1079 Mass. Ave., Lunenburg, MA **Table 1** **Date: 11/20/2008**

Location	Carbon Dioxide (ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
Outside (Background)	401	34	87					Snow/mist
229	1290	66	39	0	Y	Y	Y	Dry erase markers, 2 water-damaged ceiling tiles
230	1282	73	29	18	Y	Y	Y	Door open
228	1381	71	28	22	Y	Y	Y	Dry erase markers, door open
227	1582	71	29	20	Y	Y	Y	Dry erase markers
226	1323	71	27	18	Y	Y	Y	Dry erase markers
Library	762	71	23	4	Y	Y	Y	Ceiling repair
Computer Room	857	72	24	4	Y	Y	Y	30 Computers, door open, personal fan, dry erase markers, water-damaged ceiling tiles
Conference Room	864	69	24	0	N	N	N	Door vent, dry erase markers, water-damaged ceiling tiles
Guidance Office	871	69	24	1	Y	N	N	Window air conditioner, plants on floor
Mrs. Tousignant's Office	840	68	24	0	N	Y	Y	Draft in exhaust vent, door vent, supply and exhaust off

ppm = parts per million

Comfort Guidelines

Carbon Dioxide: < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems

Temperature: 70 - 78 °F
Relative Humidity: 40 - 60%

Table 1 (continued)

Location	Carbon Dioxide (ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
Technology Room	756	72	24	1	Y	N	N	Window air conditioner, water-damaged ceiling tiles
201	832	71	25	5	Y	Y	Y	Photocopier, plants on carpet, dry erase markers, window air conditioner
202	830	70	28	0	Y	Y	Y	Dry erase markers, food container reuse, hole in ceiling, clean fish tank
203	798	69	27	0	Y	Y	Y	Dry erase marker, clutter
205	524	69	23	0	Yo	Y	Y	Window open, dry erase markers
204	970	71	28	15	Y	Y	Y	Dry erase markers, 31 computers
207	563	69	23	0	Y	Y	Y	Holes in ceiling, glue on ceiling, dry erase markers
206A	1054	68	30	3	Y	N	Y	Glue and repair on ceiling, dry erase markers, personal fan
208	861	68	27	19	Y	Y	Y	Dry erase markers

ppm = parts per million
ND = non-detectable

Comfort Guidelines

Carbon Dioxide:	< 600 ppm = preferred	Temperature:	70 - 78 °F
	600 - 800 ppm = acceptable	Relative Humidity:	40 - 60%
	> 800 ppm = indicative of ventilation problems		

Table 1 (continued)

Location	Carbon Dioxide (ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
209	1304	68	32	18	Y	Y	Y	Ceiling repair, dry erase markers, clutter on univent, plants on univent
211	978	68	28	11	Y	Y	Y	Boxes near exhaust, plants on floor, plants near univent, dry erase marker, ceiling repair
212	798	70	26	1	Y	Y	Y	Ceiling repair, water-damaged ceiling, ceiling repair, dry erase markers
213	1255	71	30	16	Y	Y	Y	Objects on and near univent, holes in walls, personal fan, dry erase markers
214	816	71	26	0	Y	Y	Y	Books on univent, exhaust partially blocked, air fresheners, ceiling repair, dry erase markers, plants near univent
215	1611	70	30	20	Y	Y	Y	Dry erase markers, clutter on univent, books on overhead light fixture, exhaust partially blocked by paper
216	1682	70	32	19	Y	Y	Y	Dry erase markers, clutter on univent, plant on floor, exhaust weak and partially blocked
218	1612	70	33	18	Y	Y	Y	Dry erase markers near univent, plant on floor, exhaust partially blocked by

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Table 1 (continued)

Location	Carbon Dioxide (ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
								desk
217	1237	71	29	19	Y	Y	Y	Dry erase markers
219	888	71	26	0	Y	Y	Y	Clutter around univent, dry erase markers, exhaust partially blocked
Teachers' Dining	940	70	26	3	Y	N	Y	Door vent, ceiling repair, personal fan, radiator, musty odor
Café	1186	69	28	150+	Y	Y	Y	
Gym	835	68	26	16	N	Y	Y	Broken block windows
Weight Room	586	67	24	0	Y	Y	Y	

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Table 1 (continued)

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						Supply	Exhaust	
201	832	71	25	5	Y	Y	Y	Photocopier, plants on carpet, dry erase markers, window air conditioner
202	830	70	28	0	Y	Y	Y	Dry erase markers, food container reuse, hole in ceiling, clean fish tank
203	798	69	27	0	Y	Y	Y	Dry erase marker, clutter
205	524	69	23	0	Yo	Y	Y	Window open, dry erase markers
204	970	71	28	15	Y	Y	Y	Dry erase markers, 31 computers
207	563	69	23	0	Y	Y	Y	Holes in ceiling, glue on ceiling, dry erase markers
206A	1054	68	30	3	Y	N	Y	Glue and repair on ceiling, dry erase markers, personal fan
208	861	68	27	19	Y	Y	Y	Dry erase markers
209	1304	68	32	18	Y	Y	Y	Ceiling repair, dry erase markers, clutter on univent, plants on univent

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Table 1 (continued)

Location	Carbon Dioxide (ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
211	978	68	28	11	Y	Y	Y	Boxes near exhaust, plants on floor, plants near univent, dry erase marker, ceiling repair
212	798	70	26	1	Y	Y	Y	Ceiling repair, water-damaged ceiling, ceiling repair, dry erase markers

*ppm = parts per million in air

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Table 1 (continued)

Location	Carbon Dioxide (ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
213	1255	71	30	16	Y	Y	Y	Objects on and near univent, holes in walls, personal fan, dry erase markers
214	816	71	26	0	Y	Y	Y	Books on univent, exhaust partially blocked, air fresheners, ceiling repair, dry erase markers, plants near univent
215	1611	70	30	20	Y	Y	Y	Dry erase markers, clutter on univent, books on overhead light fixture, exhaust partially blocked by paper
216	1682	70	32	19	Y	Y	Y	Dry erase markers, clutter on univent, plant on floor, exhaust weak and partially blocked
218	1612	70	33	18	Y	Y	Y	Dry erase markers near univent, plant on floor, exhaust partially blocked by desk
217	1237	71	29	19	Y	Y	Y	Dry erase markers
219	888	71	26	0	Y	Y	Y	Clutter around univent, dry erase markers, exhaust partially blocked
Teachers' Dining	940	70	26	3	Y	N	Y	Door vent, ceiling repair, personal fan, radiator, musty odor

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Address: 1079 Mass. Ave., Lunenburg, MA **Date: 11/20/2008**

Table 1 (continued)

Location	Carbon Dioxide (ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
Café	1186	69	28	150+	Y	Y	Y	
Gym	835	68	26	16	N	Y	Y	Broken block windows
Weight Room	586	67	24	0	Y	Y	Y	
Music Room	1363	69	34	3	N	Y	Y	Dry erase markers, univent on ceiling
220	1299	70	38	1	Y	Y	Y	Dry erase markers, washer/dryer, electric stove, univent-partially blocked
221	1507	71	38	21	Y	Y	Y	Dry erase markers
222	1814	69	34	24	Y	Y	Y	Dry erase markers, books on univent, plant near univent
Storage off 222	1106	70	32	0	N	N	N	Drain, hot water exhaust. Odor noted.
Auditorium	1112	70	28	0	N	Y	Y	Recirculated air
223-Art Room	1090	71	26	7	Y	Y	Y	Kiln, univent partially blocked

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Table 1 (continued)

Location	Carbon Dioxide (ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
Art Supply Closet	1072	70	27	0	N	N	N	12, 1 gallon containers of rubber cement; Hexane spray-fix
Art Classroom	1276	70	30	21	Y	Y	Y	Ceiling repair, dry erase markers, univent partially blocked
101-Industrial Arts	677	68	25	14	Y	Y	Y	Univent noisy, paint cans and wood present, exhaust venting to outside
103-Film Developing area				0	N	N	N	Sulfur odor noted, two abandoned sinks with dry drain traps
105	488	70	23	0	Y	Y	Y	Window air conditioner, abandoned eyewash
104-Chemistry	1036	70	27	24	Y	Y	Y	Acid storage cabinet and Flammable Storage cabinet present
107	1492	69	31	17	Y	Y	Y	Dry erase markers, food containers
106	1063	69	28	0	N	N	N	Dry erase markers, food containers, plants near univent
108	948	69	27	1	Y	Y	Y	Dry erase markers
109	1014	70	28	14	Y	Y	Y	Dry erase markers, empty soda bottles

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Table 1 (continued)

Location	Carbon Dioxide (ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
Mechanical Room	563	71	24	0	N	Y	Y	Metallic taste noted by large capacity hot water heater

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Appendix A

Actions on Previous MDPH Recommendations

The following is a status report of actions taken on MDPH recommendations (**in bold**). The summary is based on reports from Lunenburg High School Department Officials, as well as photographs and observations made by MDPH staff.

- Remove leaves and other debris from univent fresh air intake subterranean pits, clean & inspect periodically.

  Action Taken: Leaves are removed from the fresh air intake subterranean pits annually after leaf fall is complete.

- Disconnect the flammable storage cabinet from the PVC pipes and reseal the cabinet with its original bunghole caps.

  Action Taken: Completed.

- Disconnect the vent attached to the chemical hood duct. Render the chemical hood duct airtight.

  Action Taken: Completed.

- Repair back-drafting exhaust vents.

  Action Taken: As denoted in report, exhaust vents were not operating in some locations due to motor malfunction at time of this assessment.

- Remove/relocate compost pile from inner courtyard.

  Action Taken: Compost heap remain in courtyard.

- Remove plants from floor with wall-to-wall carpeting. Move plants away from univents in classrooms. Ensure plants have drip pans. Examine drip pans periodically for mold growth and disinfect with an appropriate antimicrobial where necessary. Consider reducing the number of plants in certain areas.

  Action Taken: Plants remain on carpeting, see report.

- Vent clothes dryers directly outdoors.

  Action Taken: Completed.

- Repair water damaged sink countertops.

  Action Taken: Completed.

- Install guard along edge of chemical storage area shelves.

  Action Taken: Completed.

- Defrost refrigerator and remove chemical. If containers are damaged, dispose of chemicals in a manner consistent with Massachusetts hazardous waste laws and regulations.

  Action Taken: Not completed by science faculty.

- Remove mold colonized materials from the fall out shelter. Disinfect non-porous surfaces with an appropriate antimicrobial.

  Action Taken: Completed.

Long Term Recommendations

- Examine the feasibility of providing local exhaust ventilation for printing press machines and photocopying equipment in graphics classroom. If not feasible, consider moving graphic arts to another room where local exhaust ventilation can be provided.

  Action Taken: Press machines and photocopying equipment removed.

- Examine the feasibility of replacing damaged gymnasium block windows.

  Action Taken: See report.

- Examine the feasibility of restoring exhaust ventilation for room 239.

  Action Taken: Completed